LANDSLIDES

HARIS KUMAR S
2025255014
MSC Applied geology

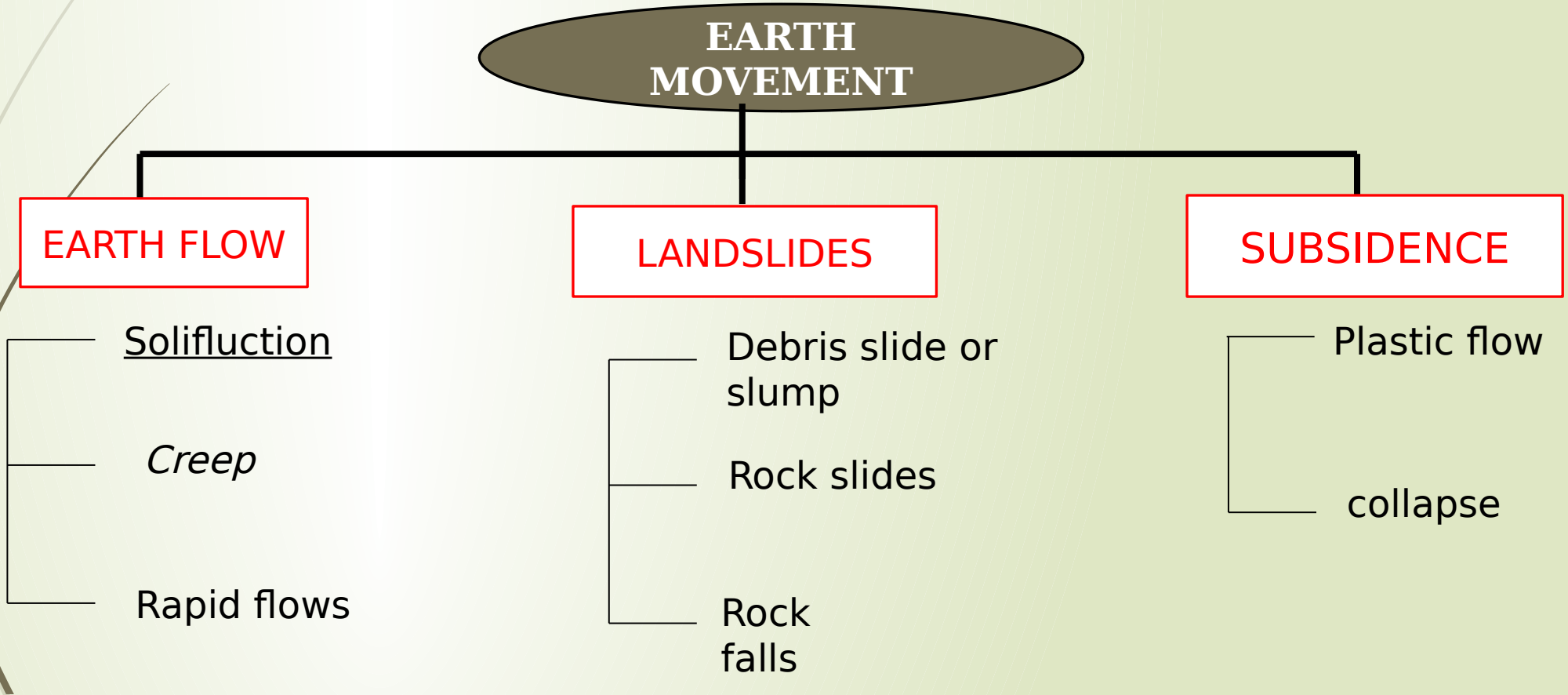
INTRODUCTION :

- Landslide: refers to the downward sliding of huge quantities of land mass.
- Which occur along steep slopes of hills or mountains and may be sudden or slow.

- Large block known as a slump block moves during the landslide.
- The scar above a landslide is easily visible.
- They can occur along a slope where the internal resistance of the rocks are reduced or they loose their holding capacity.
- Common after earthquakes or after removal of part of the slope due to construction,

CLASSIFICATION OF EARTH MOVEMENT :

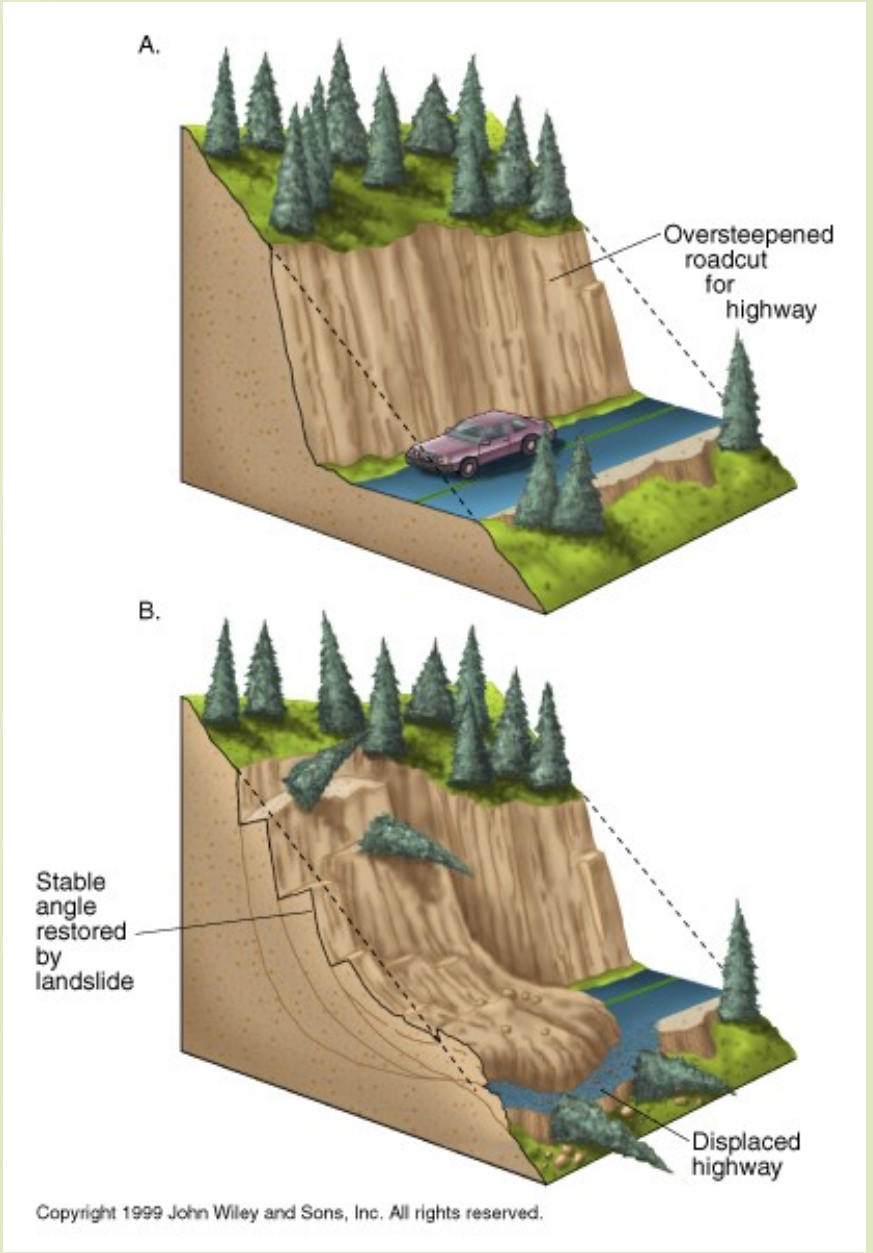
All movement of land masses are referred as landslides, but differ in many respects, therefore all types of landslides are categorized as Earth Movements.



Movement of landslide can result into:

<u>Debris slides</u> - are failure of unconsolidated material on a surface

<u>Rock slide or Rock Fall</u> – where movement of large rock block rolls



Water is the most powerful solvent

Pore Water Pressure is the key to monitoring landslides. Shear strength (resisting force) decreases and the weight (driving force increases).

Slope stable upto certain angle- "Critical angle" or "angle of repose" – it varies from 30^0 for unconsolidated sediments to 90^0 for massive rocks and 60^0-90^0 for partially jointed rocks

When rain water percolates through some fractures or joints the clayey beds becomes very plastic and acts as slippery base, which enhance the chances of loose overburden to slip downward.

TYPES OF LANDSLIDES

1. Rockfall

Sudden falling of rocks from steep cliffs or slopes
And due to weathering, erosion, or earthquakes
Common in mountainous areas.

2. Debris Flow

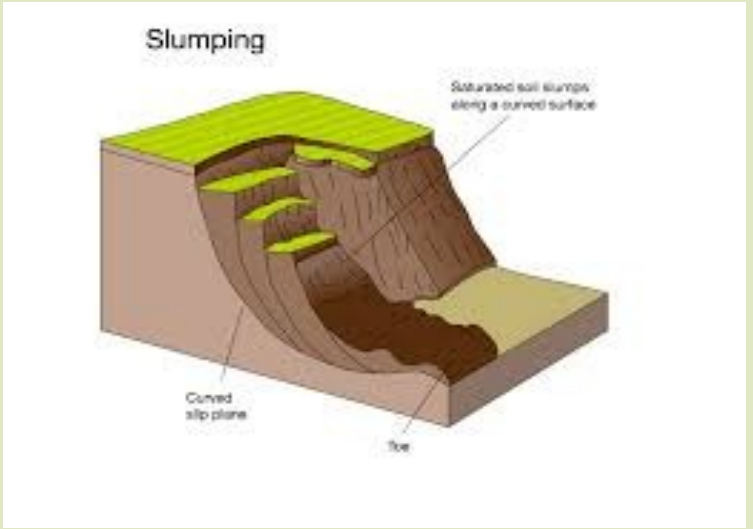
Rapid movement of loose rocks, soil, and water down a slope and Usually occurs after heavy rainfall and Very destructive and fast-moving

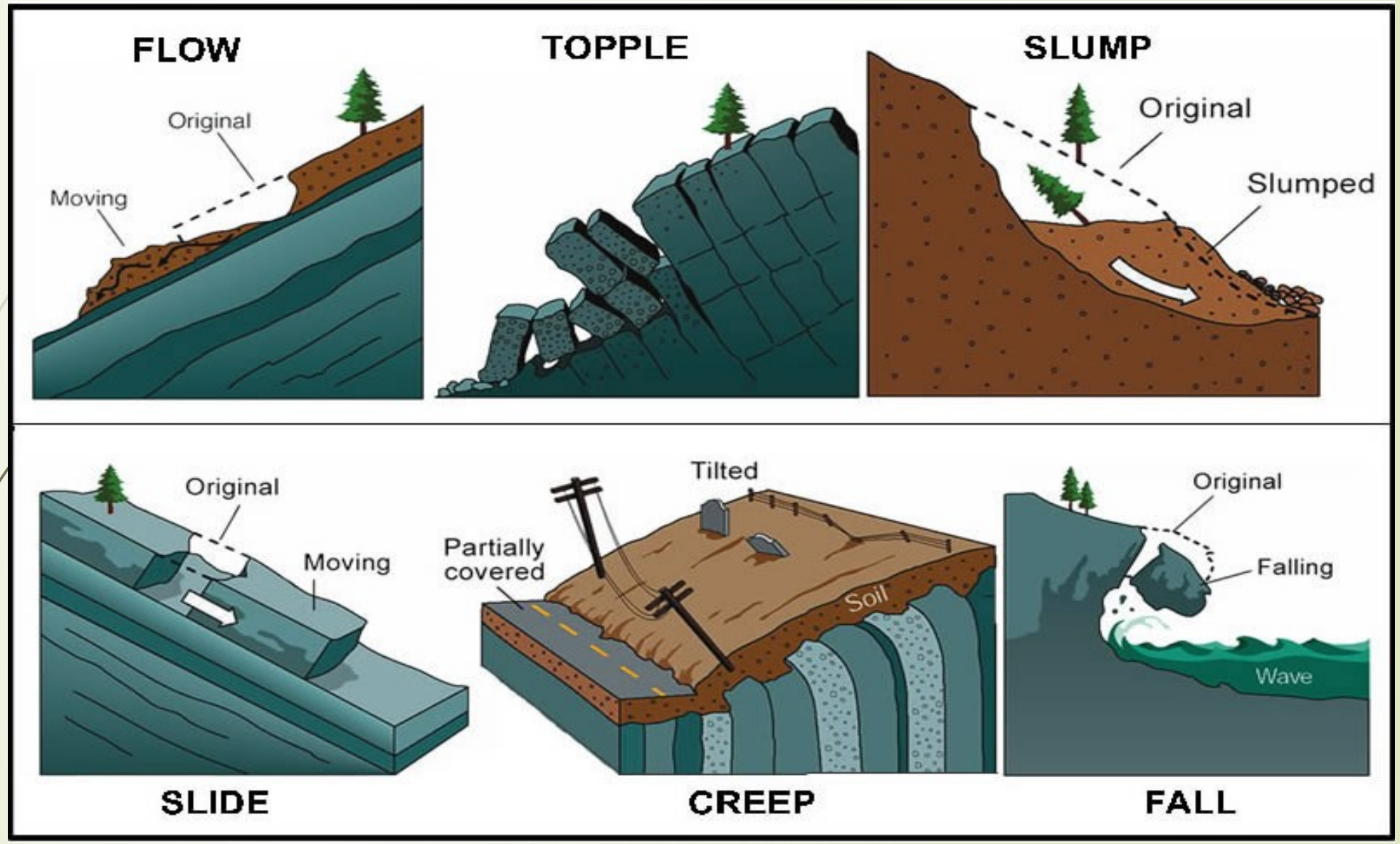
3. Mudflow

Flow of very wet soil and mud down a slope and
Moves like a thick liquid Often occurs in areas with heavy rain

4. Slump

Mass of soil or rock moves slowly down a slope along a curved surface and land surface may form step-like terraces after the slump
The sliding material usually moves as one block.




FLOW
Original
Moving
TOPPLE
SLUMP
Original
Slumped
Original
Moving
SLIDE
Tilted
Partially covered
Soil
CREEP
Original
Falling
Wave
FALL

CAUSES OF LANDSLIDES

Natural

- HEAVY RAINFALL
- EARTHQUAKE
- VOLCANIC ACTIVITY
- EROSION BY FULIDS
- WEATHERING

Human

- DEFORESTATION
- MINING AND QUARRYING
- ROAD CONSTRUCTION
- CONSTRUCTION OF BUILDINGS
- POOR DRAINAGE SYSTEM
- UNPLANNED URBANIZATION

Causes of Landslides

Natural Causes

- **Heavy rainfall**

Continuous rain saturates the soil and makes it heavy and loose, causing it to slide

- **Earthquakes**

During an earthquake shake the ground and loosen rocks and soil, triggering landslides

- **Volcanic activity**

Eruptions and volcanic ash can weaken mountain slopes and
cause them to collapse

- **Erosion by rivers or waves**

Water erodes the base of hills or cliffs, making the slope unstable

- ***Weathering of rocks***

Over time, rocks break into smaller pieces due to wind, water, and temperature changes, weakening the slope.

Human Causes

- **Deforestation**

Cutting down trees removes roots that hold the soil together, making slopes loose and unstable.

- ***Mining and Quarrying***

Blasting and digging during mining weaken the structure

rocks and soil on slopes

- ***Road Construction***

Cutting hills to build roads disturbs the natural stability of slo

❖ Construction of Buildings

Building houses, dams, and other heavy structures on slopes adds extra weight and pressure.

❖ Poor Drainage Systems

Water from leaking pipes or blocked drainage can accumulate in soil and reduce its strength

❖ Unplanned Urbanization

Rapid development in hilly areas without proper planning can destabilize slopes.

MITIGATION

Mitigation refers to the actions taken to **reduce or minimize the impact of disasters and hazards** before they occur

- Focuses on **prevention and risk reduction**
- Helps protect **people, property, and the environment**
- Includes **structural and non-structural measures**

SLOPE STABILIZATION

VEGETATION

DRAINAGE CONTROL

MONITORING AND EARLY WARNING

SLOPE STABILIZATION

Slope stabilization is the process *of* strengthening and supporting a slope to prevent landslides or soil movement.

Retaining Walls:

Structures built at the base of slopes to hold soil in place

Rock Bolts and Anchors:

Used to secure unstable rock masses on steep slopes.

Terracing:

Cutting the slope into steps to reduce steepness and prevent soil erosion.

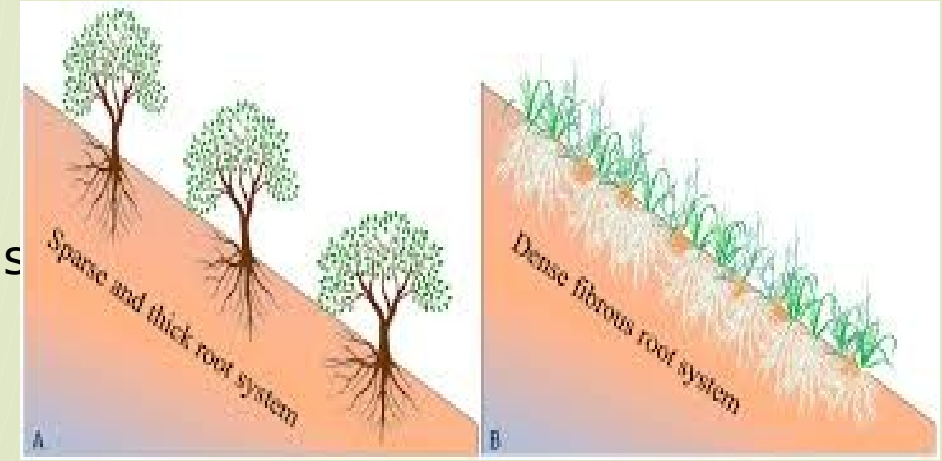
Rock nets:

Rock nets are protective wire mesh systems installed on slopes or cliffs to prevent rocks from falling and causing damage or injuries.

VEGETATION

Vegetation helps reduce landslides by stabilizing soil with plant roots and reducing soil erosion on slopes.

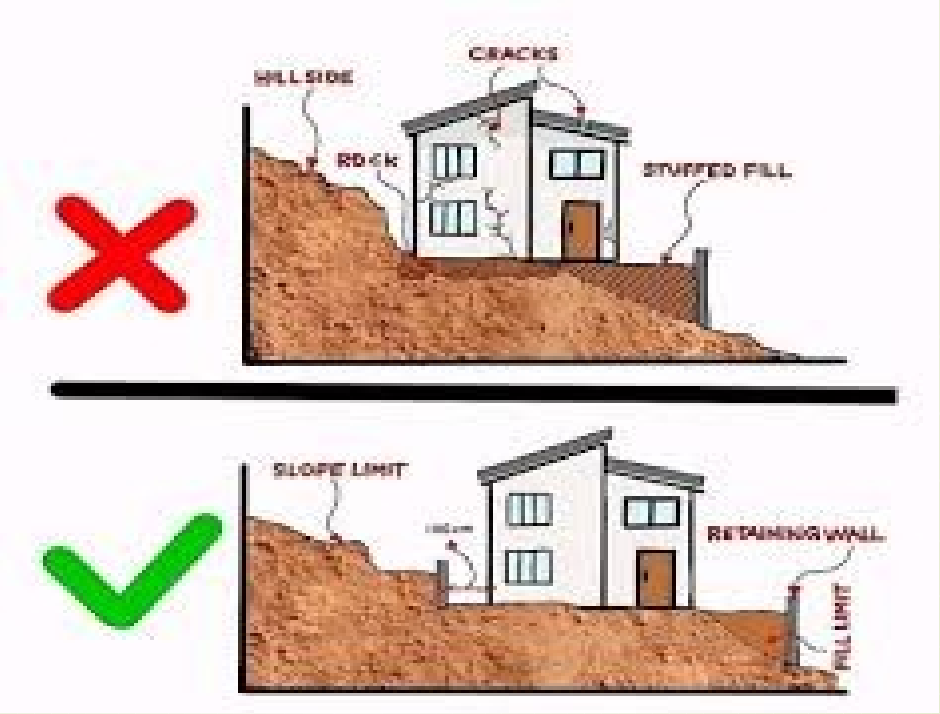
- **Afforestation** (planting trees in barren areas)
- **Reforestation** (replanting trees in deforested areas
- **Grass turfing** on slopes



DRAINAGE CONTROL

Drainage control is the process of managing and removing excess water from slopes to prevent landslides.

- *Water increases the weight of soil.*
- *It reduces soil strength and makes slopes unsta*ble.



MONITORING AND EARLY WARNING

Monitoring and early warning systems help detect signs of landslides in advance and warn people before a disaster occurs.

- **Satellites** – Observe large-scale land changes from space
- **Rainfall** – Measures rainfall that can trigger landslides.
- **Drones** – Monitor slope conditions in real-time.
- **Inclinometers** – Measure slope angle changes
- **Cracks** – Monitor new cracks in soil, roads, or

CONCLUSION

“Landslides are natural hazards that can cause severe damage, but through proper mitigation measures, slope stabilization, drainage control, vegetation, monitoring, and early warning systems, their impact can be minimized, protecting lives and property”

Proper mitigation and monitoring can reduce the damage caused by landslides

THANKYOU